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Detecting Electrical Anomalies via Overlapping Measurements

Sina Sontowski

Mentors: Nigel Lawrence, Deepjyoti Deka

August 1st, 2021





Overview



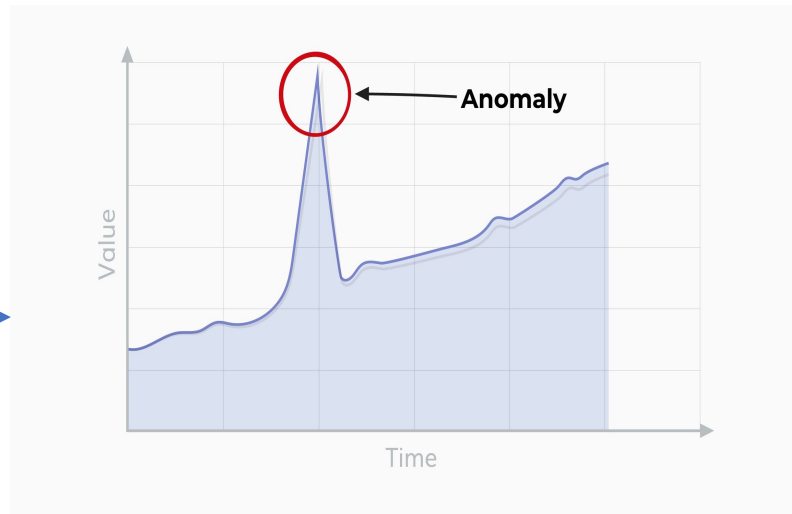
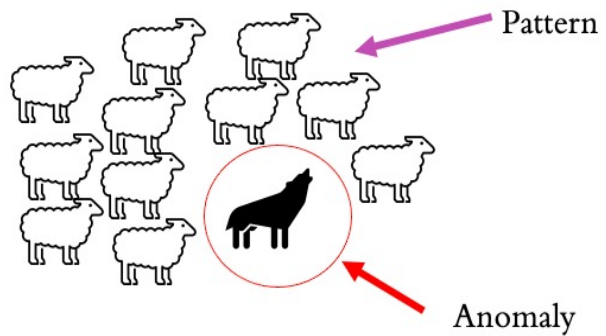
Background
Time Series
Anomaly
Detection

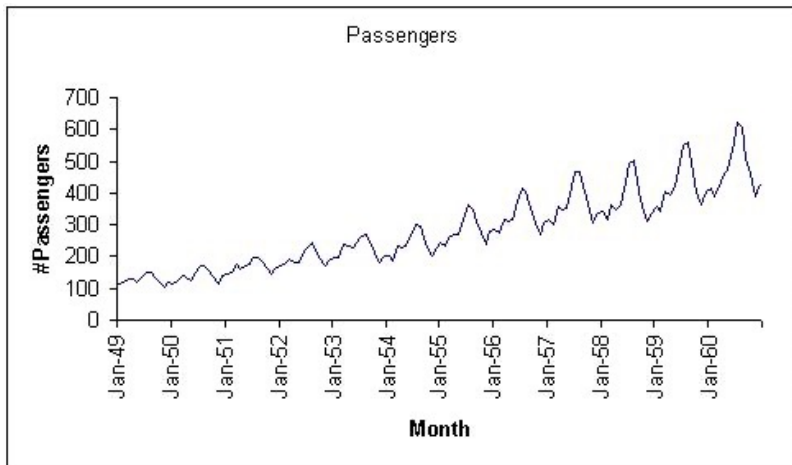


Overview of my
Research and
Importance

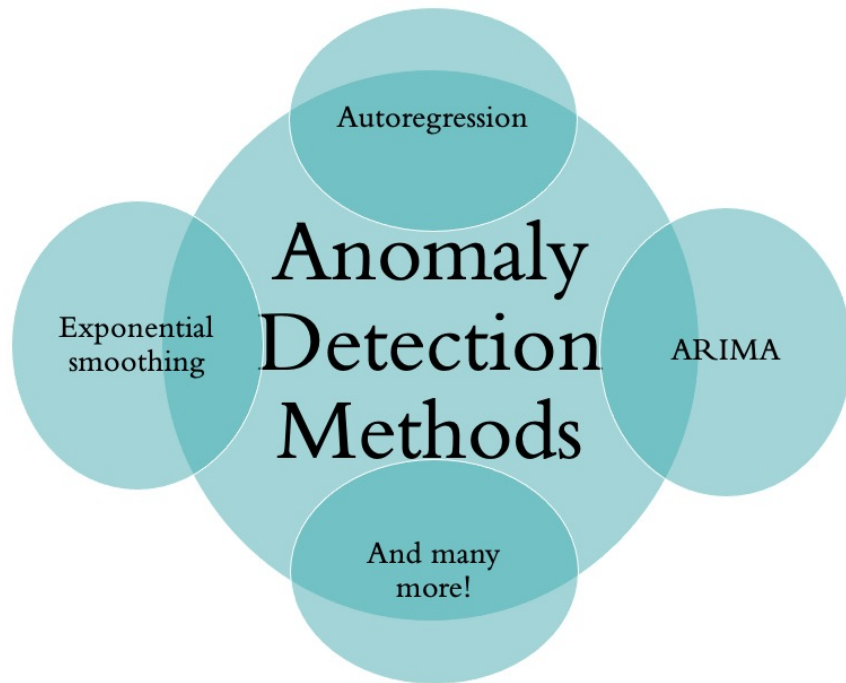
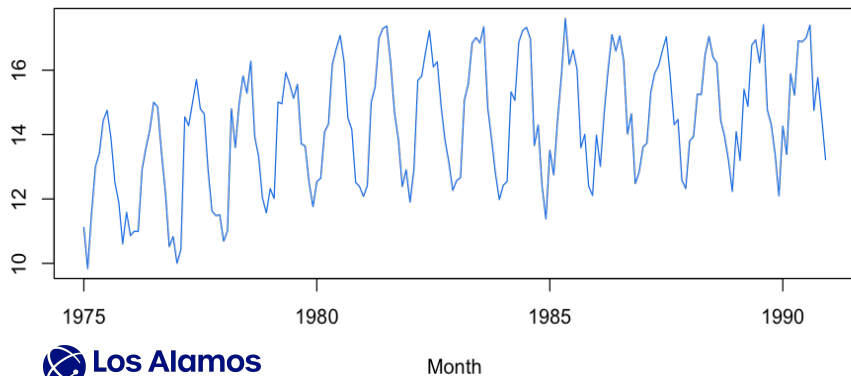


Results and
Conclusion





Monthly beer sales in millions of barrels



My research



Start

Multiple
independent
systems with
electrical
measurements



Method

Anomaly
Detection



Goal

Improve
speed/accuracy
and validate
measurements

Main Contributions



Dealing with overlapping electrical measurements and validate them

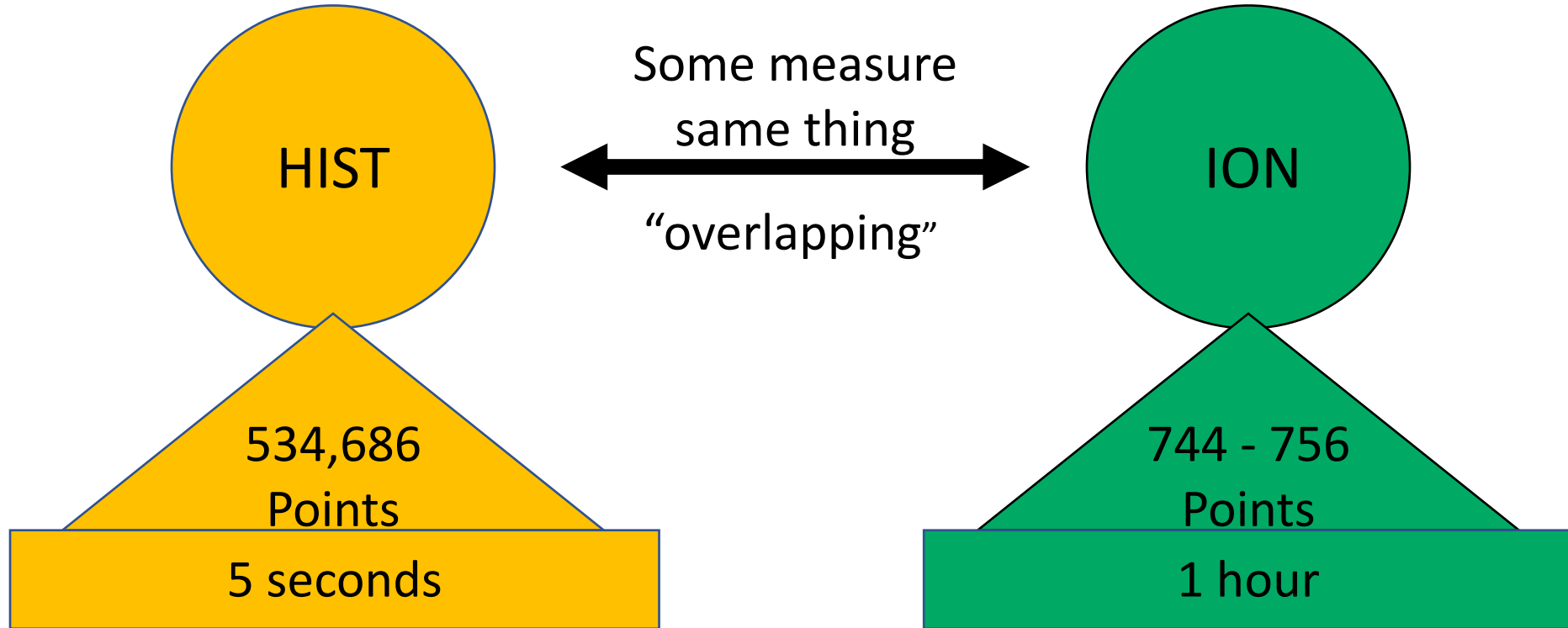


Compare results of anomaly detection algorithms

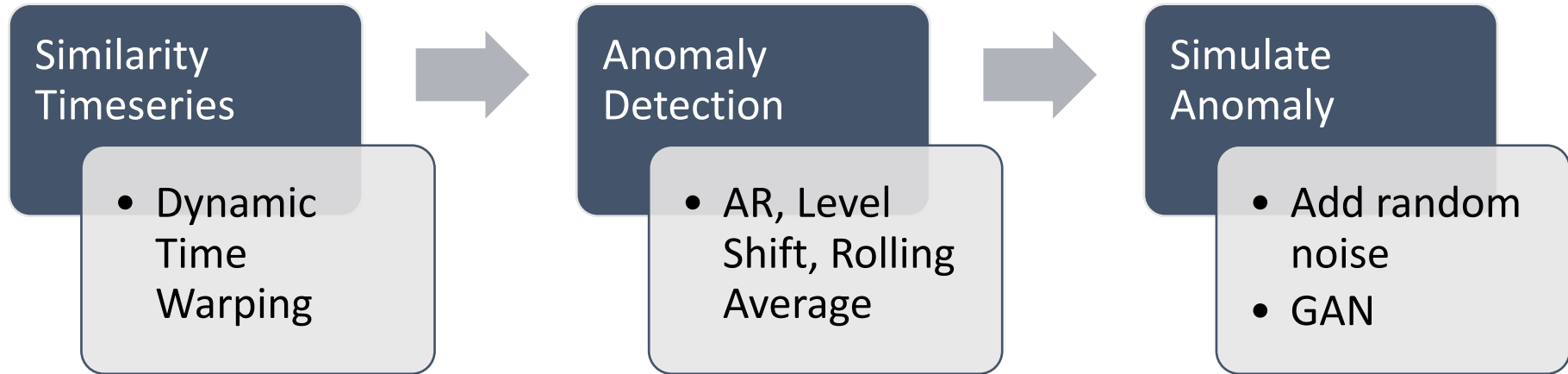


Improve accuracy/speed of anomaly detection (work in progress)

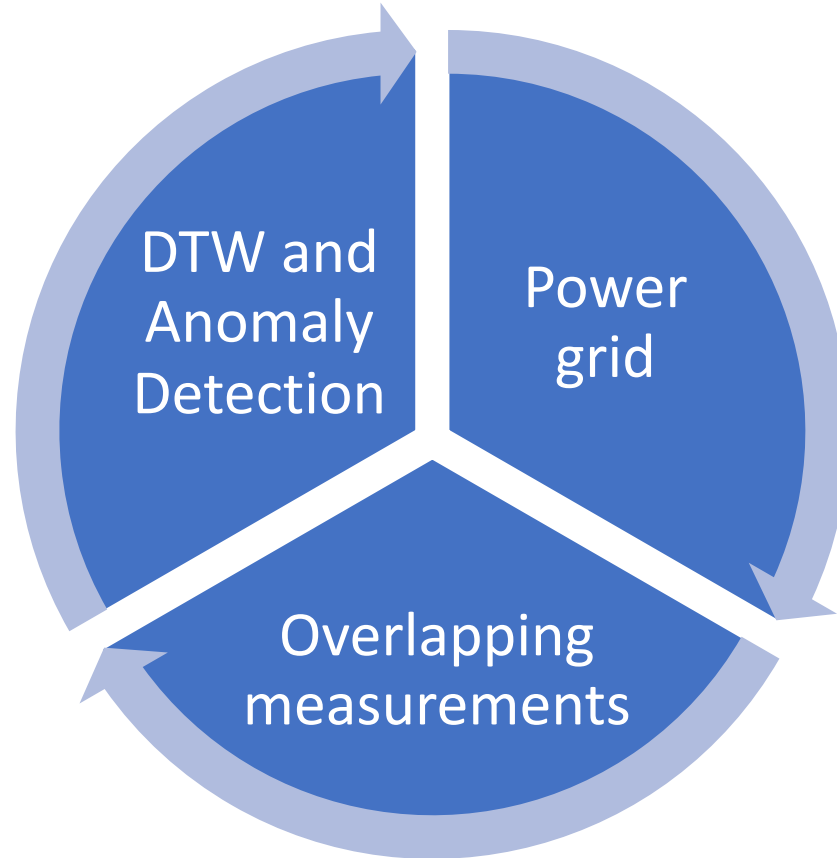
About the electrical measurements



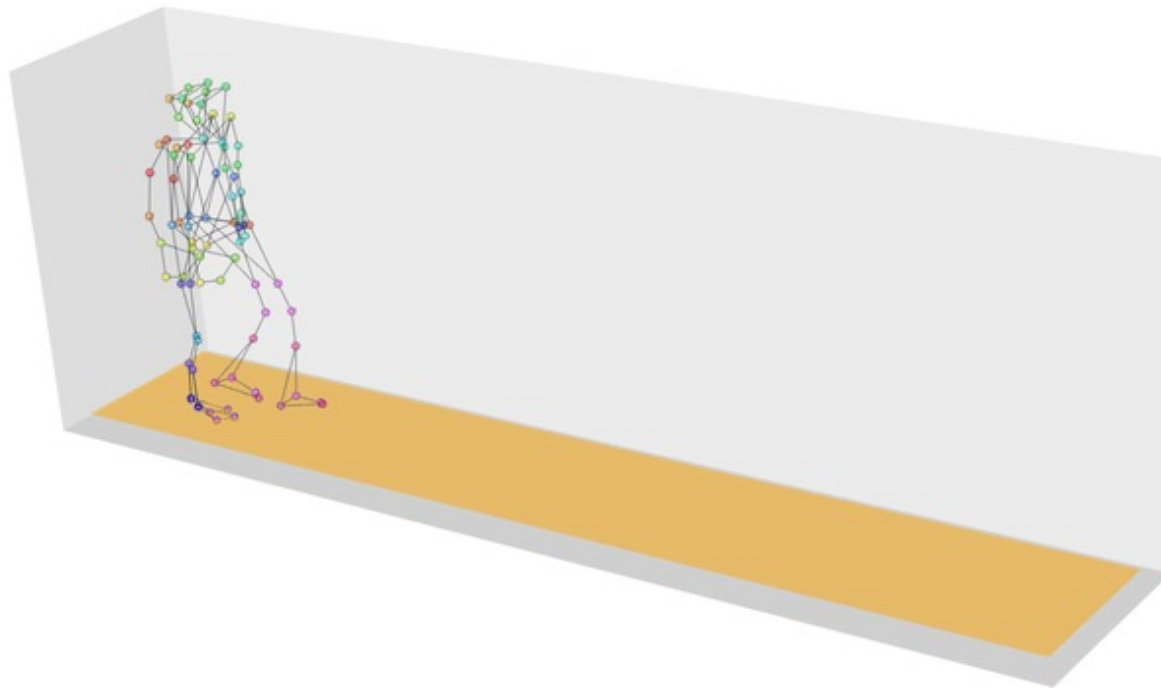
Our Approach



Why our Research is Unique



Dynamic Time Warping (DTW)



Representative Sample

Step Size

- Taking every second point

Certain Point Amount

- First 200 Points

Date Range

- Three days

Run-time of Step size runs

Run Number	HIST steps	ION steps	Run-time (s)
1	100	2	2318.6
2	1000	1	616.7
3	1000	2	342.8
4	2000	2	222.6
5	3000	4	108.6
6	5000	7	65.7

Table 1: Step Size Running Times.

Run-time of Point Amount and Date Range

Run Number	Point Amount	Run-time (s)
7	100	24.3
8	200	38.6

Table 2: Point Amount Running Times.

Run Number	Date Range	HIST steps	ION steps	Run-time (s)
9	3 days	50	1	191.8

Table 3: Date Range Running Times.

Anomaly Detection



Rolling Average

The diagram shows a light blue rounded rectangle with a dark blue header bar at the top. A white rounded rectangle is positioned in front of it, slightly offset to the right and bottom, creating a layered effect.



Autoregression

The diagram shows a light blue rounded rectangle with a dark blue header bar at the top. A white rounded rectangle is positioned in front of it, slightly offset to the right and bottom, creating a layered effect.



Level Shift

The diagram shows a light blue rounded rectangle with a dark blue header bar at the top. A white rounded rectangle is positioned in front of it, slightly offset to the right and bottom, creating a layered effect.

Steps:

100 HIST

2 ION

Runtime: 2318.579178094864

0.0 : ['ION_4-3472', 'HIST_40_S']

0.9019789354524411 : ['ION_5-139', 'HIST_40_S']

3.1622776601683795 : ['ION_4-3472', 'HIST_44_S']

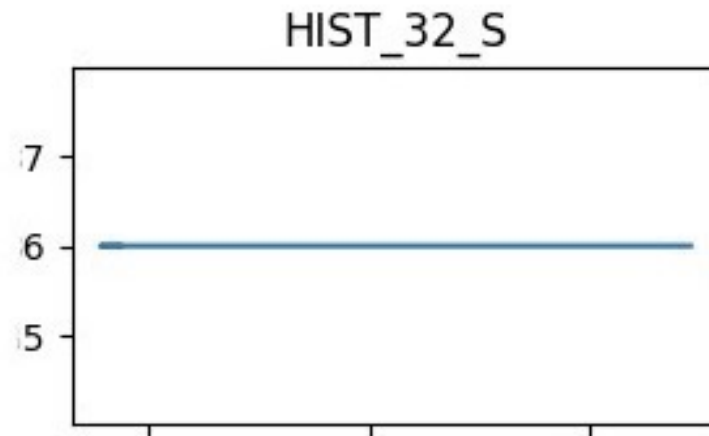
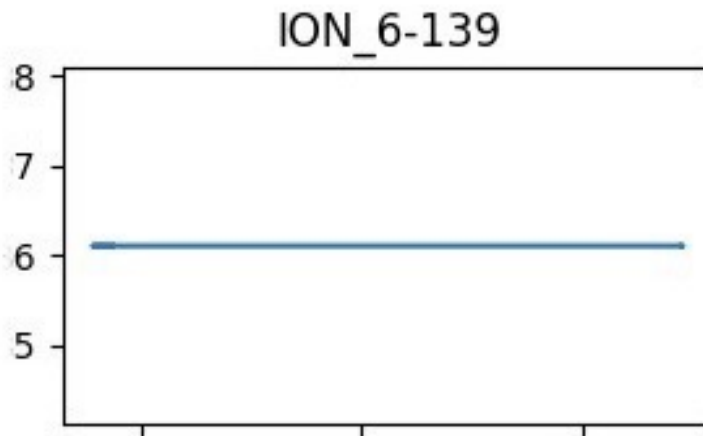
3.272547325860909 : ['ION_5-139', 'HIST_44_S']

4.47213595499958 : ['ION_6-6', 'HIST_44_S']

6.928203230275509 : ['ION_6-4', 'HIST_44_S']

9.382502917665077 : ['ION_6-139', 'HIST_32_S']

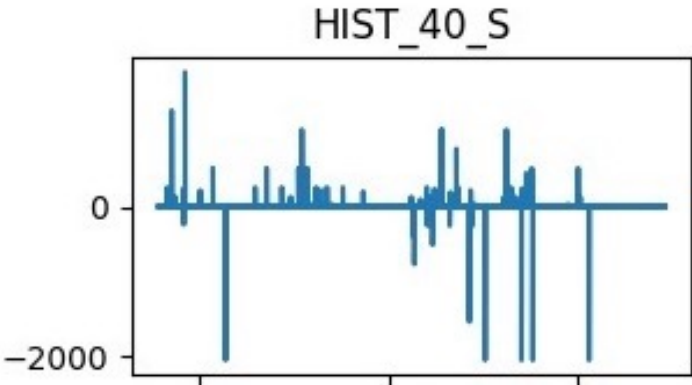
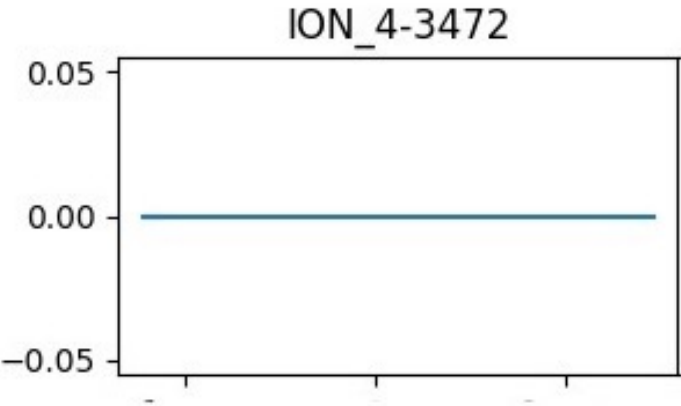
Results



Steps:
100 HIST
2 ION
Runtime: 2318.579178094864

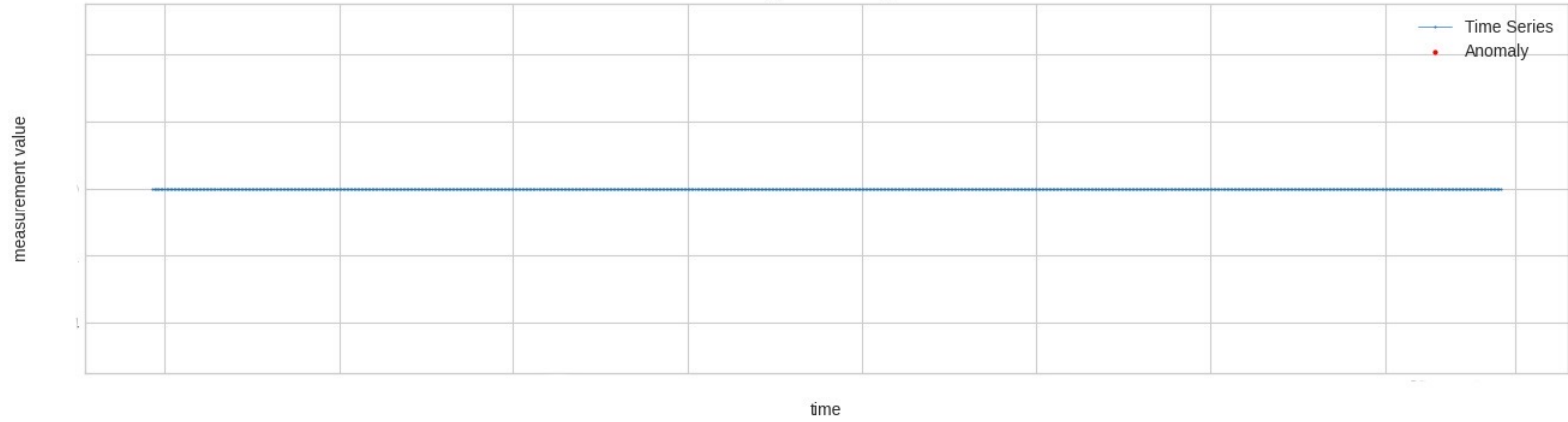
Results

0.0 : ['ION_4-3472', 'HIST_40_S']
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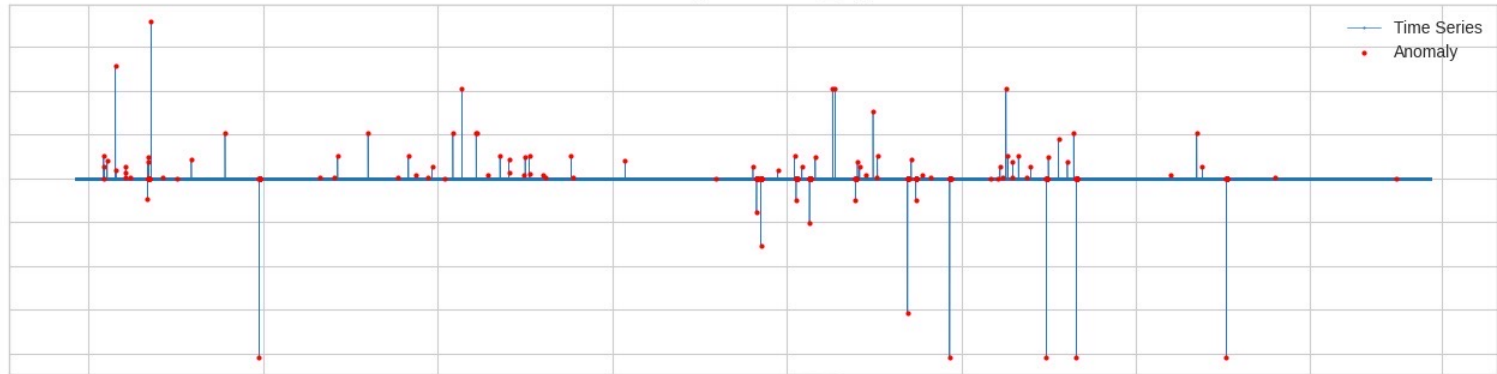


epoch time

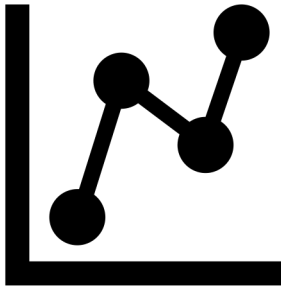
Auto Regression ION_4-3472



Auto Regression HIST_40_S



Future Work



Simulate
Artificial
Anomaly

Steps:

100 HIST

2 ION

Runtime: 2318.579178094864

0.0 : ['ION_4-3472', 'HIST_40_S']

0.9019789354524411 : ['ION_5-139', 'HIST_40_S']

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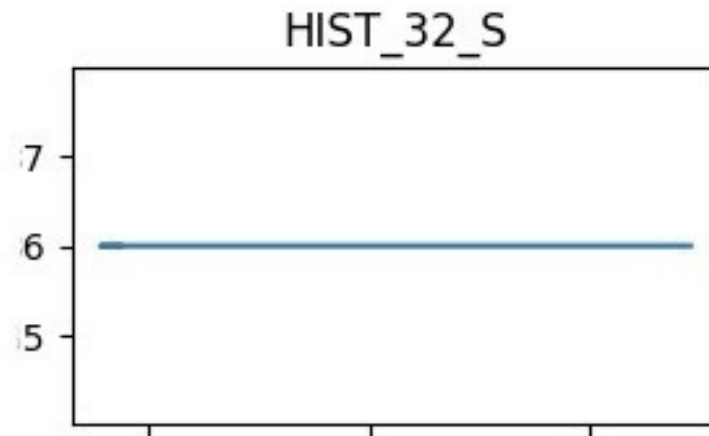
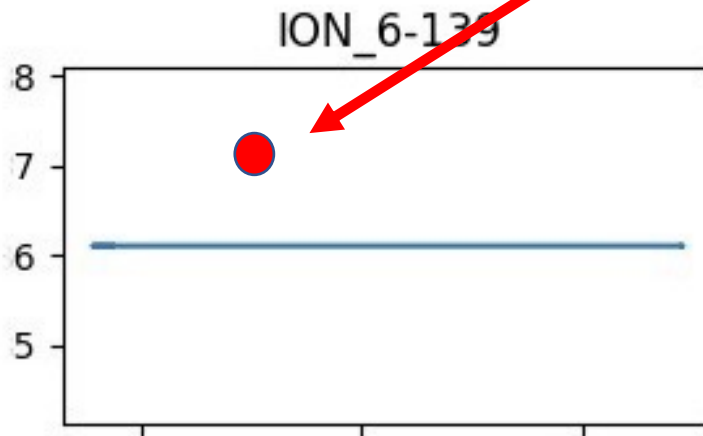
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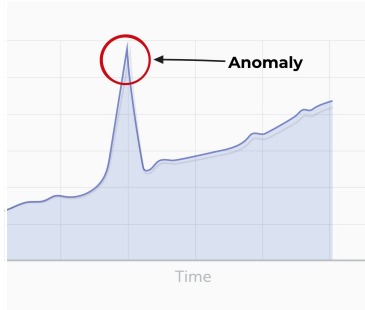
9.382502917665077 : ['ION_6-139', 'HIST_32_S']

Anomaly



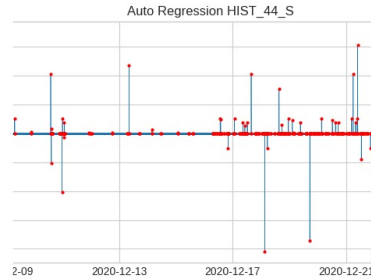
time

Conclusions



What is Anomaly Detection?

Background



Time Series Anomaly Detection

Applications



My research

Importance